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COST AND SCHEDULE FOR DRILLING
AND MINING UNDERGROUND TEST FACILITIES

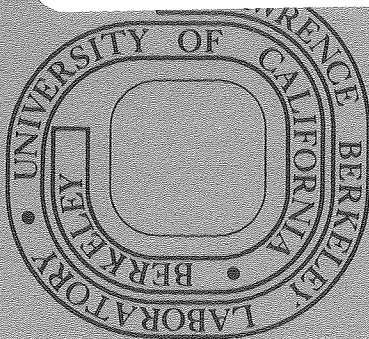
D.W. Lamb

September 1980

Prepared for the U.S. Department of Energy
under Contract W-7405-ENG-48

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COST AND SCHEDULE FOR
DRILLING AND MINING UNDERGROUND TEST FACILITIES

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September 1980

Prepared for the U. S. Nuclear Regulatory Commission under
Interagency Agreement DOE 50-80-97, N.R.C. FIN No. B 3110-0
by Lawrence Berkeley Laboratory, University of California,
Berkeley, California 94720 under Contract W-7405-ENG-48
with the U. S. Department of Energy.

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ABSTRACT

Cost estimates and lead times are calculated for a mining and drilling program to establish underground test facilities at depths of 300, 700 and 1500 metres. Estimates are provided for establishing the facility in an existing mine and in a mine opened for the facility. The Stripa test facility in Sweden is used as a model in this study for the facility design and the drilling program.

Cost estimates and lead time range from just less than \$1.5 million and 10 months for an existing mine at 300 metres to \$15 million and 58 months for a new mine at 1500 metres. Lithologies of granite, high-grade metamorphic rock, sedimentary rock with argillaceous strata at the depth of the facility, and tuffaceous rock were considered; the effect of lithology on the cost and schedule of opening a test facility was found to be relatively insignificant.

1 - INTRODUCTION

This study was performed by Acres American Incorporated for the Regents of the University of California for the University's Lawrence Berkeley Laboratory (LBL). The scope of study is set forth in Section 3.

The purpose of the study was to develop an approximation of cost and time to complete mining and core drilling for underground test facilities at various depths and in various rock types as a necessary part of LBL's research on rock mechanics and fracture hydrology.

2 - SCOPE OF WORK

2.1 - Background

The Scope of Work called for a study to provide costs estimates and approximate lead times for mining and associated core drilling for underground test facilities at depths of 300, 700 and 1500 metres in existing operating mines and in new facilities opened from the surface specifically for the test facility. Estimates and schedules were to be made for test facilities in 4 rock types: granite, high-grade metamorphic rock, sedimentary rock with argillaceous strata at the depth of the facility and in tuffaceous rock.

As directed in a letter dated October 26, 1979, from Dr. Cohen of LBL, the following reports were used by Acres as the basis for developing the scope, costs and schedules for the work:

- (a) Borehole Drilling and Related Activities at the Stripa Mine, Technical Project Report No. 5, Swedish-American Cooperative Program on Radioactive Waste Storage in Mined Caverns in Crystalline Rock, LBL-7080.
- (b) Mining Methods Used in the Underground Tunnels and Test Rooms at Stripa, Technical Project Report No. 8, Swedish-American Cooperative Program on Radioactive Waste Storage in Mined Caverns in Crystalline Rock, LBL-7081.
- (c) Underground Test Facilities to Resolve Scientific and Technical Questions on Isolating High-Level Nuclear Waste in Fractured Rocks (DRAFT), LBL-9791.

The Stripa mine in Sweden was chosen as a test facility to investigate the problems of terminal storage of radioactive waste in crystalline rock. Because Stripa is an existing mine located at the required depth, tunnelling for test facilities could begin without the additional costs and delays of opening a new mine. Preparation for installation of instrumentation required

a tunnelling and drilling program. Tunnelling was done by drilling and smooth blasting. Four hundred metres of drifts (10,000 M³ of rock) were excavated for access and test facilities. Drilling took place on the surface and in the mine. Surface drilling consisted of seven shallow holes for groundwater monitoring and two deep holes to the level of the mine to identify geologic structure. Subsurface drilling was carried out in four test drifts. Over 150 borings of various sizes and lengths were drilled for the placement of instrumentation.

The drilling program and mining methods used at the Stripa mine, as referenced above, formed the basis for estimating the drilling and excavation quantities for this study. The cost estimates and schedules in this study were divided into the following four discrete packages:

1. Surface Drilling
2. Shaft Sinking
3. Facility Development
4. In-Mine Drilling

The cost and time required for shaft sinking applies only to a new facility mined from the surface.

2.2 - Surface Drilling

It has been assumed that drilling from the surface would be done for both new and existing mine facilities. The program would consist of both core and percussion drilled holes, as was done at Stripa. Oriented core samples would be used for identifying rock types and geologic structures above and below the mine. Core drilling would be less extensive at an existing mine because the geology of the site area would be better known. Core drilling would consist of:

- For a new mine: Seven vertical, 76 mm diameter (N-size) holes from surface to a depth of 200 metres below the level of the test facility,
- For an existing mine: Three vertical, 76 mm diameter holes from the surface to a depth of 200 metres below the facility.

Based on previous experience, it is assumed that verticality measurements, to measure the amount of deviation of the core hole, will be taken after every 30 metres of drilling, and wedging and hole alignment would be performed to maintain the desired hole orientation. It is assumed that, on an average, one alignment will be necessary between depths of 30 to 300 metres, and one alignment for every additional 100 metres of drilling. The amount of wedging and hole alignment is dependent on the orientation of planar features in the rock with respect to the boring.

Percussion drilled holes would be used for groundwater monitoring. Seven vertical, 116 mm diameter holes would be drilled for both new and existing mines. The depth of the percussion holes is dependent on groundwater conditions at a particular site. Assuming similar conditions as at Stripa, there would be 500 metres of percussion drilling at each site.

In this report, drill sizes are given in the metric system: Table 1 shows the equivalent, standard U.S. drill bit sizes.

2.3 - Site Preparation and Shaft Sinking (New Mine)

In establishing a test facility in a new mine, it will be necessary to sink a 5 m finished diameter main access shaft from the surface to the test level by conventional methods. The conventional shaft sinking method, which is the most common method of shaft excavation, involves the drilling and blasting of shallow vertical cuts followed by mucking and hoisting of the blasted rock to the surface.

Before the shaft sinking can commence, a shaft collar and headframe must be constructed. The shaft collar is constructed through the overburden and weathered rock zone and anchored into sound rock. Excavation for the collar is usually carried out using a large mobile crane with a clam-shell type bucket with access to the shaft bottom provided by a ladder way. The concrete shaft collar extends through overburden to the top of sound rock which for this analysis has been assumed to be 30 metres below the surface. From the surface to a depth of 4.5 metres, the collar consists of a concrete slab with an outside diameter of 11 metres and an inside diameter of 5 metres. From

4.5 to 30 metres, the collar consists of 1 metre thick concrete walls with an inside diameter of 5 metres.

The time required to establish the collar through overburden to sound rock is extremely sensitive to actual site conditions. For this analysis, it has been assumed that the overburden is unconsolidated soils with a high water table requiring special methods to be adopted to keep the excavation open during initial sinking operations. Such methods would include dewatering, grouting and, under extreme conditions in highly pervious loose soils, freezing operations.

Once the shaft concrete forms are installed and the shaft collar poured, work on the headframe begins. The headframe is equipped with the necessary hoisting machinery, rope sheaves, shaft sinking stage and hoists required for shaft sinking and underground construction. When the headframe is completed, shaft sinking begins. Typically, a multi-working deck sinking stage is used to perform the excavation. In cross-section, the sinking stage would have three circular openings through the decks. Two of these openings would permit two sinking buckets to be used for simultaneous hoisting of the shaft rock. The third opening would provide for the passage of the large drill jumbo and a Cryderman-type mucker. Suspended below the sinking stage would be a ground support platform which can be lowered below the stage so that rock bolting, meshing and shotcreting can be carried out between the stage and shaft bottom.

The stage ropes, suspended in the shaft, are utilized as guides for the cross-heads of the two rock buckets. The cross-heads keep the buckets stabilized during the fast travel through the shaft. Special cross-heads are used to raise and lower the drill jumbo and the Cryderman mucker along the shaft centerline.

The shaft is excavated approximately 1 metre wider than the nominal concrete lined diameter. Drilling is performed with the use of drill jumbo or hand-held drilling machines. Blast holes are drilled in a symmetric, conical drill pattern to depths of approximately 3 metres, and loaded with a gelatin-type explosive.

Rock removal is generally performed with a Cryderman mucker which loads the rock into cargo hoisting buckets. After the shaft bottom has been cleaned of rock, the platform is lowered and the exposed rock between the stage and shaft bottom is rock bolted, meshed and/or shotcreted as required to provide for temporary support and safety for the shaft crew. This cycle is subsequently repeated and, when 6 metres of shaft has been excavated, this portion of the shaft is concrete lined and ventilation duct installed. The drilling, mucking and concrete lining cycle is repeated throughout the full depth of the shaft. This method of shaft sinking requires a great deal of time, particularly in the mucking and hoisting cycles of the operation.

Ventilation would be provided through a 1 metre diameter duct that is installed as the shaft is excavated to the test level, thus providing ventilation to the workers as the shaft progresses. The 5 metre diameter shaft is large enough to allow for ventilation intake through the 1 metre diameter duct (Figure 1) and discharge directly up the shaft and hence a separate, smaller diameter vent shaft would not be necessary. The single shaft arrangement will be equipped with an emergency exit cage and hoist. In the event that second shaft is required for any reason, it could be constructed with an Alimak, raising the shaft full face from the test level to the surface. Limitations of Alimak raising, however, may require the excavation of a cross drift from the 5 metre diameter shaft at a depth of approximately 750 metres and Alimak raising in two steps for the 1,500 m deep scheme.

2.4 - Facility Development

Plans for test facilities in new and in existing mines are shown in Figure 2. The plans are based on the Stripa mine, where approximately 400 metres of 5 metre diameter drifts were excavated for access and test instrumentation. It is assumed that 400 metres would be excavated for both a new and an existing mine.

Excavation would be by drilling and smooth blasting. Four jackleg drills would be used to drill a 62 hole blast pattern to a depth of 3 metres. A drill-blast-muck cycle would take one 8-hour shift. With two shifts per day, excavations would proceed at 6 metres per day. Where necessary, rock bolts and wire mesh would be installed and the rock surface shotcreted.

The ventilation requirements during construction for a new mine are estimated at 40,000 cfm. To provide this quantity of air would require fan horsepower of 30 and 40 for the ventilation of the 300 and 700 m levels respectively. For the 1,500 m test level, a 75 horsepower fan would be required midway down the shaft in addition to a 60 hp fan at the surface.

The rate of seepage water inflow into the shaft and test facility will depend on rock type and groundwater conditions. For estimating purposes a pump-out capacity of 200 gpm has been allowed for each of the new sites.

2.5 - In-Mine Drilling

In-mine drilling would be done in the full-scale, time-scaled, extensometer and ventilation drifts (Figure 2). It is assumed that the location, amount and type of drilling for both new and existing mines would be the same as at the Stripa mine. Drilling would consist of over 150 core borings ranging in size from 38 to 406 mm diameter and generally less than 15 m in depth. They would be drilled vertically, horizontally and inclined. The Stripa drilling program included "slot" drilling a 1000 mm diameter "core", and also a 470 m vertical boring from the 410 m level. Table 1 is a summary of the in-mine drilling program.

3 - COST ESTIMATES

3.1 - Assumptions

The unit prices and costs used for this study have been based on Acres past experience in estimating and administering surface and subsurface drilling, shaft sinking, and development of underground excavations.

This section presents the cost estimate for developing a test facility at the previous specified depths. The effect of rock type on costs and schedule was evaluated and found to be relatively insignificant. For example, harder rock is more expensive to excavate but requires less artificial support. Conversely, any cost savings that might be achieved by increased drilling and/or excavating rates in sedimentary rocks would likely be lost in the need for additional shaft and cavern support and stabilization. The difference in total cost for developing a test facility in any of the four rock types was found to be small and well within the allotted 20% contingency. Therefore, no distinction was made in differentiating costs between the various rock types. Six basic site alternatives were developed for estimating purposes as follows:

1. New mine facility at 300-metre depth
2. New mine facility at 700-metre depth
3. New mine facility at 1,500-metre depth
4. Existing mine facility at 300-metre depth
5. Existing mine facility at 700-metre depth
6. Existing mine facility at 1,500-metre depth

Because of the generic nature of the study, certain general conditions and assumptions were made in developing costs. These assumptions and conditions are as follows:

- (a) The site is readily accessible, that is, men and materials can be brought to and moved around the site without the use of heavy equipment, such as, helicopters.
- (b) Water for drilling and construction purposes will be either available on site or within reasonable truckable distances.

- (c) By its nature, the site will not be close to major population centers; however, it will be close to a supply of labor and general support facilities for men and equipment.
- (d) Power will be available at or near the site.

These conditions and assumptions will likely be met if the test facility is planned for an existing mine. The basis for the estimates are discussed below with the detailed costs presented in Tables 2, 3, 4, 5, 6 and 7 and are summarized in Table 8.

3.2 - Surface Drilling

The cost estimates for surface drilling are presented in Tables 2, 3, 4, 5, 6 and 7 and are summarized in Table 8. The costs for this work are itemized as follows:

- Mobilization/Demobilization: Preparation of the drilling equipment for drilling program, transportation to the site, and the dismantling and removal of the drills from the site at completion of the work. No specific site and/or geographic area had been identified for this study, but the estimates presented in Tables 2, 3, 4, 5, 6, 7 and 8 represent the costs for standard types of drilling equipment with mobilization over a distance of less than 500 miles. It is assumed that a larger rig will be needed for the 1500 metre holes, and so the mobilization costs will be higher.
- Set-Up: The assembly, dismantling, and moving of the drill rig for one borehole location to another. The set-up costs are based on the use of standard drilling equipment at readily accessible drill sites.
- Standby Time: The cost of the driller's time during periods when drilling has been delayed by non-drilling related factors. For the purpose of this estimate, standby was assumed to be one hour per 30 metres of drilling.

- Drilling: The cost of rig rental, consumables, drill crew with accommodations, subsistence and transportation to perform actual rock drilling. This is based on a cost per metre drilled and is depth dependent.
- Core Boxes: The price of wooden boxes and transportation of core to an on-site storage facility. Assume each core box holds five metres of core.
- Special Operations:
 - Verticality Measurements: Cost associated with measuring borehole verticality. Assume one measurement for every 30 metres of core drilling.
 - Wedging and Hole Alignment: Cost associated with maintaining hole orientation. Cost is depth dependent.
 - Backfilling Boreholes: Covers the cost of materials and labor for backfilling the boreholes with cement grout over their full depth.
 - Suveying: Costs for borehole locations are estimated at a rate of \$300 per day for a three-man crew. The time required would be dependent on the location of control points, but for the purpose of this estimate, it was assumed that control for a new mine would require 10 days, while that for an existing mine could be completed in three days.

No costs have been included for in-hole testing such as in-hole geophysics, hydrofracturing for stress determination and pressure testing. The scope of in-hole testing will be dependent on the needs and aims of the program. It is important to note, however, that the costs for such a program may add between \$100,000 to \$200,000 to the surface drilling program because of the time, equipment and sub-contractors that would be needed to perform the variety of tests.

3.3 - Shaft Sinking

The cost estimates for developing the 5 metre shaft are presented in Tables 2, 3, 4, 5, 6 and 7 and are summarized in Table 8. The costs for this work are itemized to include:

- Mobilization: All costs associated with mobilizing the shaft sinking contractor to the site, establishment of a temporary construction office, workshops, equipment and all services and utilities.
- Headframe Collar: All costs associated with excavating through overburden and weathered rock to sound rock and the construction of a concrete collar to support the headframe. Sound rock is assumed to be at a depth of 30 metres below grade.
- Headframe: All costs associated with procurement and erection of the permanent headframe to serve the main access hoist.
- Sinking Hoist: All costs associated with procurement and erection of the sinking hoist used for construction purposes.
- Hoist House: All costs of construction of a foundation and procurement and erection of a pre-engineered steel building.
- Shaft Sinking: Costs of labor and material to sink a 5 metre finished diameter shaft by conventional drilling, blasting and mucking techniques to the depth of the facility.
- Alimak (Optional): Costs includes mobilization, assembly, drilling, blasting and mucking operations related to Alimak raising. The cost of the additional Alimak shaft has been separated from the cost estimates as an optional item on Table 8.

The cost of a permanent hoist has not been included in the cost estimate for shaft sinking. The type of permanent hoist to be installed is dependent on the weight and dimensions of the materials that would be transported into the mine.

3.4 - Facility Development

3.4.1 - New Mine

The cost estimates for excavating a new mine are presented in Tables 2, 3, 4, 5, 6 and 7 and are summarized in Table 8. The costs for this work are itemized to include:

- Mobilization: All costs associated with transporting labor and equipment to the site and down the access shaft for rock excavation.
- Drifts: Costs for equipment, materials, and labor for rock excavation and rock supports.
- Pump Station: Costs include procurement and installation of pumps and discharge pipe to the surface.
- Ventilation: Costs include procurement and installation of fans, ducts, flow controls and power.

3.4.2 - Existing Mine

It has been assumed that where the test facility is constructed from within an operating mine, the mine hoisting, ventilation and pumping facilities would be sufficient to meet the requirements of the construction of the test drifts and in-mine drilling requirements. It is anticipated that some charges would be made by the mine owners for use of their facilities, but no allowance for such costs has been made in the estimates.

3.5 - In-Mine Drilling

The location, size and depth of subsurface borings are based on the in-mine drilling program performed at Stripa and are summarized in Table 1. The cost estimate has been based on the use of drill rigs working two shifts per day with each rig requiring a two-man crew.

The costs for in-mine drilling have been broken into the following items:

- Mobilization and Demobilization: All costs associated with mobilizing the drill rigs and associated equipment to perform the work, moving equipment down the shaft to the underground facility, and removal of equipment upon completion of work. The cost is based on the assumption that adequate hoisting facilities will be provided to transport all equipment into and out of the mine.
- Drilling: All direct and indirect costs for in-mine drilling. Included in this figure are the costs incurred for setting up and moving between boring locations. A daily rate was included for in-mine drilling because of the problems, delays, and complications associated with underground work. It has been Acres experience that a contractor would prefer to bid such work on a daily or hourly rate because of the uncertainties of achieving a specified rate of drilling per day under such conditions.
- Core Boxes: The cost of core boxes and the labor required to transport the boxes out of the mine to a storage facility within close proximity to the shaft collar.
- Surveying: All costs for underground surveying for the drilling program to include locating boreholes prior to and after drilling and hole orientation. The unit cost was based on costs incurred at the Stripa mine.

4 - SCHEDULE

The schedule for the development of the six alternative test facilities is presented in Figures 3 & 4. The schedules have been based on:

- Acres experience in surface and subsurface exploration and development of underground facilities:
- Discussion with experts knowledgeable in shaft sinking and mine excavations; and
- The work performed at Stripa.

Certain assumptions were made in the development of the sequence of scheduled activities. These are stated below:

4.1 - Surface Drilling

Acres assumed that the intent of the surface drilling program is to confirm the feasibility of the rock body for the development of a test facility and that no other activities would begin until this is nearing completion. Mobilization for shaft sinking (for the new mine) is assumed to begin during the last month of the drilling. The schedule for surface drilling assumes one month for standby, standby time and drilling time which is depth dependent. The drilling time assumes two drill rigs working two shifts per day six days per week.

4.2 - Shaft Sinking (New Mine)

The time schedule for site preparation and shaft sinking is shown on Figure 3. The schedule assumes a 6-day work week with 3 shifts per day. The basis of this schedule is as follows:

- Mobilization of the contractor was assumed to be one month.
 - The headframe and collar construction schedule will be site specific. The time for construction is dependent on local geologic conditions. Where competent rock is close to the surface, less time will be needed for collar excavation and construction. For this study a depth to competent rock of 30 metres was chosen. The following assumptions were made:
 - Collar Excavation:
 (1,500 m³ excavated at 75 m³ per day) 20 Days
 - Collar Construction:
 - Surface to 4.5 metres:
 - Forms (228 m² @ 38 m²) 6 Days
 - Rebar 4 Days
 - Concrete 3 Days
 - 4.5 metres to 30 metres:
 - Forms, rebars and concrete at
 2.5 days/1 m section 64 Days
 - Erect Steel Headframe 44 Days
 141 Days
 - Contingency to Allow for Poor
 Overburden Conditions (approximately 30%) 42 Days
 183 Days
 (approximately 8 months)
 - Sinking hoist and house construction was assumed to be 2 months.
 - 5-metre diameter shaft sinking is based on the following production rates:

0	-	300 m at 3 m/day
300	-	700 m at 2.5 m/day
700	-	1,500 m at 2 m/day
- Production efficiency was assumed to be 50% for the first month, 75% for the second month and 100% for the remaining months of construction.

4.3 - Facility Development

The schedule for facility development assumes excavation of 400 metres of drifts for both a new and an existing facility. This includes drilling, blasting, mucking, rock bolting, installing ventilation and pumps. The calculated rate of advance is 6 metres/day. For an existing mine, one month mobilization for the contractor is assumed. Mobilization is scheduled to begin one month before the completion of the surface drilling. It is assumed that the contractor for the shaft in the new mine will complete the drifts as well.

4.4 - In-Mine Drilling

This schedule assumes one month mobilization, 0.5 months to assemble equipment in the test facility excavation, drilling time and standby of 2.5 months plus one month for additional delays which usually occur during underground work. Mobilization is scheduled to begin one month before the end of drift excavation.

As shown in Figure 4, the schedule for development of a test facility ranges from 10 months for the 300-metre level existing mine to 58 months for a new mine at 1,500 metres. No provision has been made in the schedules for:

- Site selection
- Obtaining applicable licenses, applications and/or permits
- Preparation, issuance and award of surface drilling specifications, and
- Raising (if required) of a 2-metre diameter ventilation shaft.

If an additional ventilation shaft is required for the new mines, then 2.8, 6.5 and 13.8 months must be added to the development schedule for the 300 m, 700 m and 1,500 m new mine sites if the shaft were to be raised from the test facility to the surface. Alternative construction methods for this shaft such as full bore drilling from the surface or back reaming through a pilot hole and slashing down might be possible for the 300 m level. Such methods would save some time and should be considered at the detailed design stage.

TABLES

TABLE 1
IN-MINE DRILLING PROGRAM

<u>Drift</u>	<u>Borehole Diameter (mm)</u>	<u>Number of Borings</u>	<u>Average Depth (m)</u>	<u>Total Length (m)</u>
Time-Scaled	38 (EX)	16	9	144
	46 (AX)	2	14	28
	56 (BX)	1	7	7
	76 (NX)	5	20	100
	127*	8	11	88
Full-Scale	38 (EX)	45	9	405
	56 (BX)	7	7	49
	76 (NX)	12	20	240
	406*	2	6	12
Extensometer	38 (EX)	20	9	180
	46	2	14	28
	76 (NX)	18	20	} 830
		1	470	
Ventilation	76 (NX)	15	20	300
	1000**	1	2	2

() Equivalent U.S. borehole diameter.

* No equivalent U.S. drill bit size.

** 1000 mm diameter slot-drilled "core" location not specified



ESTIMATE

TABLE 2

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 1 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CASE 1 - NEW MINE 300 M BELOW GROUND						
1.1	<u>Surface Drilling</u>						
1.1.1	Mobilization/Demobilization						
	a) Core rig	2	Lump	\$10,000	\$ 20,000		
	b) Percussion rig	1	Lump	7,000	7,000		
1.1.2	Set-Up						
	a) Core	7	Hole	800	5,600		
	b) Percussion	7	Hole	800	5,600		
1.1.3	Standby Time	117	Hour	80	9,360		Allow 1 hour standby for every 30 M of drilling.
1.1.4	Core Drilling						
	a) 0-200 M	1,400	M	57	79,800		
	b) 200-400 M	1,400	M	66	92,400		
	c) 400-500 M	700	M	77	53,900		Core drilling to 200 M below depth of mine.
1.1.5	Percussion Drilling	500	M	15	7,500		
1.1.6	Core boxes & transportation of core to storage area	700	Each	20	14,000		
1.1.7	Backfilling Boreholes Cement (94 lb. bag)	500	Bag	20	10,000		

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ESTIMATE

TABLE 2

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 2 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	Special Operations						
1.1.8	Verticality Measurements	117	Each	\$ 105	\$ 12,285		
1.1.9	Wedging & Hole Alignment						
	a) 30-300 M	7	Each	1,350	9,450		
	b) 300-500 M	14	Each	1,630	22,820		
1.1.10	Surveying	10	Day	300	<u>3,000</u>		
	SUBTOTAL					352,715	
1.2	<u>Shaft Sinking</u>						
1.2.1	Mobilization		Lump		10,000		10% Equipment
1.2.2	Headframe Collar	880	CM	341	300,080		Includes excavation & Con-
1.2.3	Headframe		Lump		1,000,000		Open Steel type crete
1.2.4	Sinking Hoist		Lump		700,000		500 H.P.
1.2.5	Hoist House		Lump		20,000		Includes foundation.
1.2.6	Shaft Sinking						
	a) Labor	120	Day	3,432	411,840		
	b) Equipment Depreciation	300	M	322	96,600		
	c) Equipment Operating Cost	300	M	116	34,800		
	d) Supplies	300	M	663	198,900		
	e) Shaft Equipment		Lump		<u>227,000</u>		Includes skip & cage
					2,999,220		
1.2.7	25% Overhead & Profit				<u>749,805</u>		
	SUBTOTAL					3,749,025	



ESTIMATE

TABLE 2

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 3 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
1.3	<u>Facility Development</u>						
1.3.1	Drifts						
	a) Mobilization		Lump		\$ 5,000		Includes Access & Test Drifts
	b) Labor	68	Day	\$ 3,275	222,700		
	c) Equipment Depreciation	400	M	127	50,800		
	d) Equipment Operating Cost	400	M	65	26,000		
	e) Supplies	400	M	265	106,000		
1.3.2	Ventilation						
	a) 30 HP Fan - 273 RPM	1	Each	28,000	28,000		
	b) Vent Duct	300	M	125	37,500		
	c) Flow Controls		Lump		5,000		
	d) Power	188	Day	16	3,000		
1.3.3	Pump Station						
	a) Submersible Pump	75	HP	150	11,250		Assume 200 GPM
	b) 4" Ø sch. 40 pipe	300	M	40	12,000		
					\$ 507,250		
1.3.4	25% Overhead & Profit				126,813		
	SUBTOTAL					\$ 634,063	
1.4	<u>In-Mine Drilling</u>						
1.4.1	Mobilization/Demobilization						
	a) Core	4	Lump	10,000	40,000		
	b) Percussion	1	Lump	7,000	7,000		
1.4.2	Drilling	240	Day	1,550	372,000		
1.4.3	Core Boxes and transportation of core to storage area	484	Each	20	9,680		



ESTIMATE

TABLE 2

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 4 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
1.4.4	Surveying	2,420	M	\$ 50	\$ 121,000		
	SUBTOTAL					\$ 549,680	
	SUBTOTAL					\$ 5,285,483	
	20% Contingency					1,057,097	
	TOTAL					\$ 6,342,580	
	<u>OPTIONAL</u>						
	Alimak						
	(a) Mobilization		Lump		\$ 15,000		
	(b) Labor	72	Day	\$2,656	191,200		
	(c) Equipment Depreciation	300	M	275	82,500		
	(d) Equipment Operating Costs	300	M	100	30,000		
	(e) Supplies	300	M	100	30,000		
					\$ 348,700		
					87,175		
	25% Overhead & Profit						
	SUBTOTAL					\$ 435,875	



ESTIMATE

TABLE 3

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 1 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CASE 2 - NEW MINE 700 M BELOW GROUND						
2.1	<u>Surface Drilling</u>						
2.1.1	Mobilization/Demobilization						
	a) Core Rig	2	Lump	\$10,000	\$ 20,000		
	b) Percussion Rig	1	Lump	7,000	7,000		
2.1.2	Set-Up						
	a) Core Rig	7	Lump	800	5,600		
	b) Percussion Rig	7	Lump	800	5,600		
2.1.3	Standby Time	210	Hour	80	16,800		Allow 1 hour standby for every 30 M of drilling
2.1.4	Core Drilling						Core drilling to 200 M below depth of mine
	a) 0 - 200 M	1,400	M	57	79,800		
	b) 200 - 400 M	1,400	M	66	92,400		
	c) 400 - 600 M	1,400	M	77	107,800		
	d) 600 - 800 M	1,400	M	90	126,000		
	e) 800 - 900 M	700	M	106	74,200		
2.1.5	Percussion Drilling	500	M	15	7,500		
2.1.6	Core Boxes and transporta- tion of core to storage area	1,260	Each	20	25,200		
2.1.7	Backfilling Boreholes Cement (94 lb. bag)	900	Bag	20	18,000		

* Add Cement (94 lb. bag).



ESTIMATE

TABLE 3

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 2 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST / UNIT	AMOUNT	TOTALS	REMARKS
	Special Operations						
2.1.8	Verticality Measurements	210	Each	\$ 105	\$ 22,050		
2.1.9	Wedging & Hole Alignment						
	a) 30 - 300 M	7	Each	1,350	9,450		
	b) 300 - 600 M	14	Each	1,630	22,820		
	c) 600 - 900 M	14	Each	1,970	27,580		
2.1.10	Surveying	10	Day	300	3,000		
	SUBTOTAL					\$ 670,800	
2.2	<u>Shaft Sinking</u>						
2.2.1	Mobilization		Lump		22,500		10% Equipment
2.2.2	Headframe Collar	880	CM	341	300,080		Includes excavation & concrete
2.2.3	Headframe		Lump		1,200,000		Open Steel Type
2.2.4	Sinking Hoist		Lump		1,000,000		1,000 HP
2.2.5	Hoist House		Lump		20,000		Includes foundation
2.2.6	Shaft Sinking						
	a) Labor	280	Day	3,432	960,960		
	b) Equipment Depreciation	700	M	322	225,400		
	c) Equipment Operating Cost	700	M	116	81,200		
	d) Supplies	700	M	663	464,100		
	e) Shaft Equipment		Lump		263,000		Includes skip and cage
					\$4,537,240		
2.2.7	25% Overhead & Profit				1,134,310		
	SUBTOTAL					\$5,671,550	



ESTIMATE

TABLE 3

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 3 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
2.3	<u>Facility Development</u>						
2.3.1	Drifts						
	a) Mobilization		Lump		\$ 5,000		
	b) Labor	68	Day	\$ 3,275	222,700		
	c) Equipment Depreciation	400	M	127	50,800		
	d) Equipment Operating Cost	400	M	65	26,000		
	e) Supplies	400	M	265	106,000		
2.3.2	Ventilation						
	a) 40 HP Fan-315 RPM	1	Each	28,000	28,000		
	b) Vent Duct	700	M	125	87,500		
	c) Flow Controls		Lump		5,000		
	d) Power	348	Day	25	8,700		
2.3.3	Pump Station						
	a) Submersible Pump	200	HP	150	30,000		
	b) 4" Ø sch. 40 Pipe	700	M	40	28,000		
					\$ 597,700		
2.3.4	25% Overhead & Profit				149,425		
	SUBTOTAL					\$ 747,125	
2.4	<u>In-Mine Drilling</u>						
	(See Case 1) SUBTOTAL					549,680	
	SUBTOTAL					\$7,639,155	
	20% Contingency					1,527,831	
	TOTAL					9,166,986	



ESTIMATE

TABLE 3

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 4 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	<u>OPTIONAL</u>						
	Alimak						
	(a) Mobilization		Lump		\$ 15,000		
	(b) Labor	168	Day	\$ 2,656	446,200		
	(c) Equipment Depreciation	700	M	275	192,500		
	(d) Equipment Operating Costs	700	M	100	70,000		
	(e) Supplies	700	M	100	70,000		
					\$ 793,700		
	25% Overhead & Profit				198,425		
	SUBTOTAL					\$ 992,125	



ESTIMATE

TABLE 4

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

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FILE NUMBER _____

SHEET 1 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CASE 3 - NEW MINE 1,500 M BELOW GROUND						
3.1	<u>Surface Drilling</u>						
3.1.1	Mobilization/Demobilization						
	a) Core Rig	2	Lump	\$15,000	\$ 30,000		
	b) Percussion Rig	1	Lump	7,000	7,000		
3.1.2	Set-Up						
	a) Core Rig	7	Lump	1,200	8,400		
	b) Percussion Rig	7	Lump	800	5,600		
3.1.3	Standby Time	397	Hour	80	31,760		Allow 1 hour standby for every 30 M of drilling
3.1.4	Core Drilling						
	a) 0 - 200 M	1,400	M	57	79,800		
	b) 200 - 400 M	1,400	M	66	92,400		
	c) 400 - 600 M	1,400	M	77	107,800		
	d) 600 - 800 M	1,400	M	90	126,000		
	e) 800 - 1000 M	1,400	M	106	148,400		
	f) 1000 - 1200 M	1,400	M	122	170,800		
	g) 1200 - 1400 M	1,400	M	142	198,800		
	h) 1400 - 1600 M	1,400	M	155	217,000		
	i) 1600 - 1700 M	700	M	170	119,000		
3.1.5	Percussion Drilling	500	M	15	7,500		
3.1.6	Core Boxes and transporta- tion of core to storage area	2,380	Each	20	47,600		
3.1.7	Backfilling Boreholes Cement (94 lb. bag)	1,700	Bag	20	34,000		



ESTIMATE

TABLE 4

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 2 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	Special Operations						
3.1.8	Verticality Measurements	397	Each	\$ 105	\$ 41,685		
3.1.9	Wedging & Hole Alignment						
	a) 30 - 300 M	7	Each	1,350	9,450		
	b) 300 - 600 M	14	Each	1,630	22,820		
	c) 600 - 900 M	14	Each	1,970	27,580		
	d) 900 - 1200 M	14	Each	2,320	32,480		
	e) 1200 - 1500 M	14	Each	2,660	37,240		
	f) 1500 - 1700 M	14	Each	3,000	42,000		
3.1.10	Surveying	10	Day	300	3,000		
	SUBTOTAL					\$ 1,648,115	
3.2	<u>Shaft Sinking</u>						
3.2.1	Mobilization		Lump		\$ 48,000		
3.2.2	Headframe Collar	880	CM	341	300,080		
3.2.3	Headframe		Lump		1,400,000		
3.2.4	Sinking Hoist		Lump		1,500,000		
3.2.5	Hoist House		Lump		25,000		
3.2.6	Shaft Sinking						
	a) Labor	680	Day	3,432	2,333,760		
	b) Equipment Depreciation	1,500	M	322	483,000		
	c) Equipment Operating Cost	1,500	M	116	174,000		
	d) Supplies	1,500	M	663	994,500		
	e) Shaft Equipment		Lump		335,000		
					\$ 7,593,340		
3.2.7	25% Overhead & Profit				1,898,335		
	SUBTOTAL					\$ 9,491,675	

Includes Excavation and
Open Steel Type concrete
2,000 HP
Includes Foundation



ESTIMATE

TABLE 4

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 3 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST / UNIT	AMOUNT	TOTALS	REMARKS
3.3	<u>Facility Development</u>						
3.3.1	Drifts						
	a) Mobilization		Lump		\$ 5,000		
	b) Labor	68	Day	\$ 3,275	222,700		
	c) Equipment Depreciation	400	M	127	50,800		
	d) Equipment Operating Cost	400	M	65	26,000		
	e) Supplies	400	M	265	106,000		
3.3.2	Ventilation						
	a) 60 HP Fan - 390 RPM	1	Each	28,000	28,000		
	b) 75 HP Fan	1	Each	30,000	30,000		
	c) Ventilation Duct	1,500	M	125	187,500		
	d) Flow Controls		Lump		5,000		
	e) Power	748	Day	35	26,180		
3.3.3	Pump Station						
	a) Submersible Pump-						
	2 @ 200 HP	400	HP	150	60,000		
	b) Ø 4" sch. 40 Pipe	1,500	M	40	60,000		
					\$ 807,180		
3.3.4	25% Overhead & Profit				201,795		
	SUBTOTAL					\$ 1,008,975	
3.4	<u>In-Mine Drilling</u>						
	(See Case 1) SUBTOTAL					549,680	
	SUBTOTAL					\$ 12,698,445	
	20% Contingency					2,539,689	
	TOTAL					15,238,134	



ESTIMATE

TABLE 4

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

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SHEET 4 OF 4

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	<u>OPTIONAL</u>						
	Alimak						
	(a) Mobilization		Lump		\$ 15,000		
	(b) Labor	360	Day	\$ 2,656	956,200		
	(c) Equipment Depreciation	1,500	M	275	412,500		
	(d) Equipment Operating Costs	1,500	M	100	150,000		
	(e) Supplies	1,500	M	100	150,000		
					<u>\$1,683,700</u>		
	25% Overhead & Profit				420,925		
	SUBTOTAL					\$ 2,104,625	



ESTIMATE

TABLE 5

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 1 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CASE 4 - EXISTING MINE 300 M BELOW GROUND						
4.1	<u>Surface Drilling</u>						
4.1.1	Mobilization/Demobilization						
	a) Core Rig	2	Lump	\$10,000	\$ 20,000		
	b) Percussion Rig	1	Lump	7,000	7,000		
4.1.2	Set-Up						
	a) Core Rig	3	Lump	800	2,400		
	b) Percussion Rig	7	Lump	800	5,600		
4.1.3	Standby Time	50	Hour	80	4,000		Allow 1 hour standby for every 30 M of drilling
4.1.4	Core Drilling						
	a) 0 - 200 M	600	M	57	34,200		
	b) 200 - 400 M	600	M	66	39,600		
	c) 400 - 500 M	300	M	77	23,100		Core drilling to 200 M below depth of mine 3 vertical borings
4.1.5	Percussion Drilling	500	M	15	7,500		
4.1.6	Core Boxes and transporta- tion of core to storage area	300	Each	20	6,000		
4.1.7	Backfilling Boreholes Cement (94 lb. bag) Special Operations	214	Bag	20	4,280		
4.1.8	Verticality Measurements	50	Each	105	5,250		
4.1.9	Wedging & Hole Alignment						
	a) 30 - 300 M	3	Each	1,350	4,050		
	b) 300 - 500 M	6	Each	1,630	9,780		

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ESTIMATE

TABLE 5

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

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SHEET 2 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
4.1.10	Surveying	4	Day	\$ 300	\$ 1,200		
	SUBTOTAL					\$ 173,960	
4.3	<u>Facility Development</u>						
4.3.1	Drifts						
	a) Mobilization		Lump		5,000		
	b) Labor	68	Day	3,275	222,700		
	c) Equipment Depreciation	400	M	127	50,800		
	d) Equipment Operating Cost	400	M	65	26,000		
	e) Supplies	400	M	265	106,000		
					\$ 410,500		
	25% Overhead & Profit				102,625		
	SUBTOTAL					513,125	
4.4	<u>In-Mine Drilling</u>						
	(See Case 1) SUBTOTAL					549,680	
	SUBTOTAL					\$1,236,765	
	20% Contingency					247,353	
	TOTAL					\$1,484,118	

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ESTIMATE

TABLE 6

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 1 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CAST 5 - EXISTING MINE 700 M BELOW GROUND						
5.1	<u>Surface Drilling</u>						
5.1.1	Mobilization/Demobilization						
	a) Core Rig	2	Lump	\$10,000	\$ 20,000		
	b) Percussion Rig	1	Lump	7,000	7,000		
5.1.2	Set-Up						
	a) Core Rig	3	Lump	800	2,400		
	b) Percussion Rig	7	Lump	800	5,600		
5.1.3	Standby Time	90	Hour	80	7,200		Allow 1 hour standby for every 30 M of drilling
5.1.4	Core Drilling						
	a) 0 - 200 M	600	M	57	34,200		Core Drilling to 200 M below depth of mine
	b) 200 - 400 M	600	M	66	39,600		3 vertical borings
	c) 400 - 600 M	600	M	77	46,200		
	d) 600 - 800 M	600	M	90	54,000		
	e) 800 - 900 M	300	M	106	31,800		
5.1.5	Percussion Drilling	500	M	15	7,500		
5.1.6	Core Boxes and transporta- tion of core to storage area	540	Each	20	10,800		
5.1.7	Backfilling Boreholes Cement (94 lb. bag)	386	Bag	20	7,720		

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ESTIMATE

TABLE 6

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Test Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 2 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	Special Operations						
5.1.8	Verticality Measurements	90	Each	\$ 105	\$ 9,450		
5.1.9	Wedging & Hole Alignment						
	a) 30 - 300 M	3	Each	1,350	4,050		
	b) 300 - 600 M	6	Each	1,630	9,780		
	c) 600 - 900 M	6	Each	1,970	11,820		
5.1.10	Surveying	4	Day	300	1,200		
	SUBTOTAL					\$ 310,320	
5.3	<u>Facility Development</u>						
	(See Case 4) SUBTOTAL					513,125	
5.4	<u>In-Mine Drilling</u>						
	(See Case 1) SUBTOTAL					549,680	
	SUBTOTAL					\$ 1,373,125	
	20% Contingency					274,625	
	TOTAL					<u>\$ 1,647,750</u>	



ESTIMATE

TABLE 7

CLIENT Lawrence Berkeley Laboratory
PROJECT Cost Estimate for U/G Test Facility

TYPE OF ESTIMATE Budget

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 1 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	CASE 6 - EXISTING MINE 1,500 M BELOW GROUND						
6.1	<u>Surface Drilling</u>						
6.1.1	Mobilization/Demobilization						
	a) Core Rig	2	Lump	\$15,000	\$ 30,000		
	b) Percussion Rig	1	Lump	7,000	7,000		
6.1.2	Set-Up						
	a) Core Rig	3	Lump	1,200	3,600		
	b) Percussion Rig	7	Lump	800	5,600		
6.1.3	Standby Time	170	Hour	80	13,600		Allow 1 hour of standby for every 30 M of drilling
6.1.4	Core Drilling						Core drilling to 200 M below depth of mine 3 vertical borings
	a) 0 - 200 M	600	M	57	34,200		
	b) 200 - 400 M	600	M	66	39,600		
	c) 400 - 600 M	600	M	77	46,200		
	d) 600 - 800 M	600	M	90	54,000		
	e) 800 - 1,000 M	600	M	106	63,600		
	f) 1,000 - 1,200 M	600	M	122	73,200		
	g) 1,200 - 1,400 M	600	M	142	85,200		
	h) 1,400 - 1,600 M	600	M	155	93,000		
	i) 1,600 - 1,700 M	300	M	170	51,000		
6.1.5	Percussion Drilling	500	M	15	7,500		
6.1.6	Core Boxes and transporta- tion of core to storage area	1,020	Each	20	20,400		
6.1.7	Backfilling Boreholes Cement (94 lb. bag)	729	Bag	20	14,580		



ESTIMATE

TABLE 7

CLIENT Lawrence Berkeley Laboratory

TYPE OF ESTIMATE Budget

PROJECT Cost Estimate for U/G Facility

APPROVED BY DWL

JOB NUMBER P5666

FILE NUMBER _____

SHEET 2 OF 2

BY KJW/RL DATE 4/17/80

CHKD SNT DATE 4/17/80

No.	DESCRIPTION	QUANTITY	UNIT	COST/ UNIT	AMOUNT	TOTALS	REMARKS
	Special Operations						
6.1.8	Verticality Measurements	170	Each	\$ 105	\$ 17,850		
6.1.9	Wedging & Hole Alignment						
	a) 30 - 300 M	3	Each	1,350	4,050		
	b) 300 - 600 M	6	Each	1,630	9,780		
	c) 600 - 900 M	6	Each	1,970	11,820		
	d) 900 - 1,200 M	6	Each	2,320	13,920		
	e) 1,200 - 1,500 M	6	Each	2,660	15,960		
	f) 1,500 - 1,700 M	6	Each	3,000	18,000		
6.1.10	Surveying	4	Day	300	1,200		
	SUBTOTAL					\$ 734,860	
6.3	<u>Facility Development</u>						
	(See Case 4) SUBTOTAL					513,125	
6.4	<u>In-Mine Drilling</u>						
	(See Case 1) SUBTOTAL					549,680	
	SUBTOTAL					\$ 1,797,665	
	20% Contingency					359,533	
	TOTAL					\$ 2,157,198	

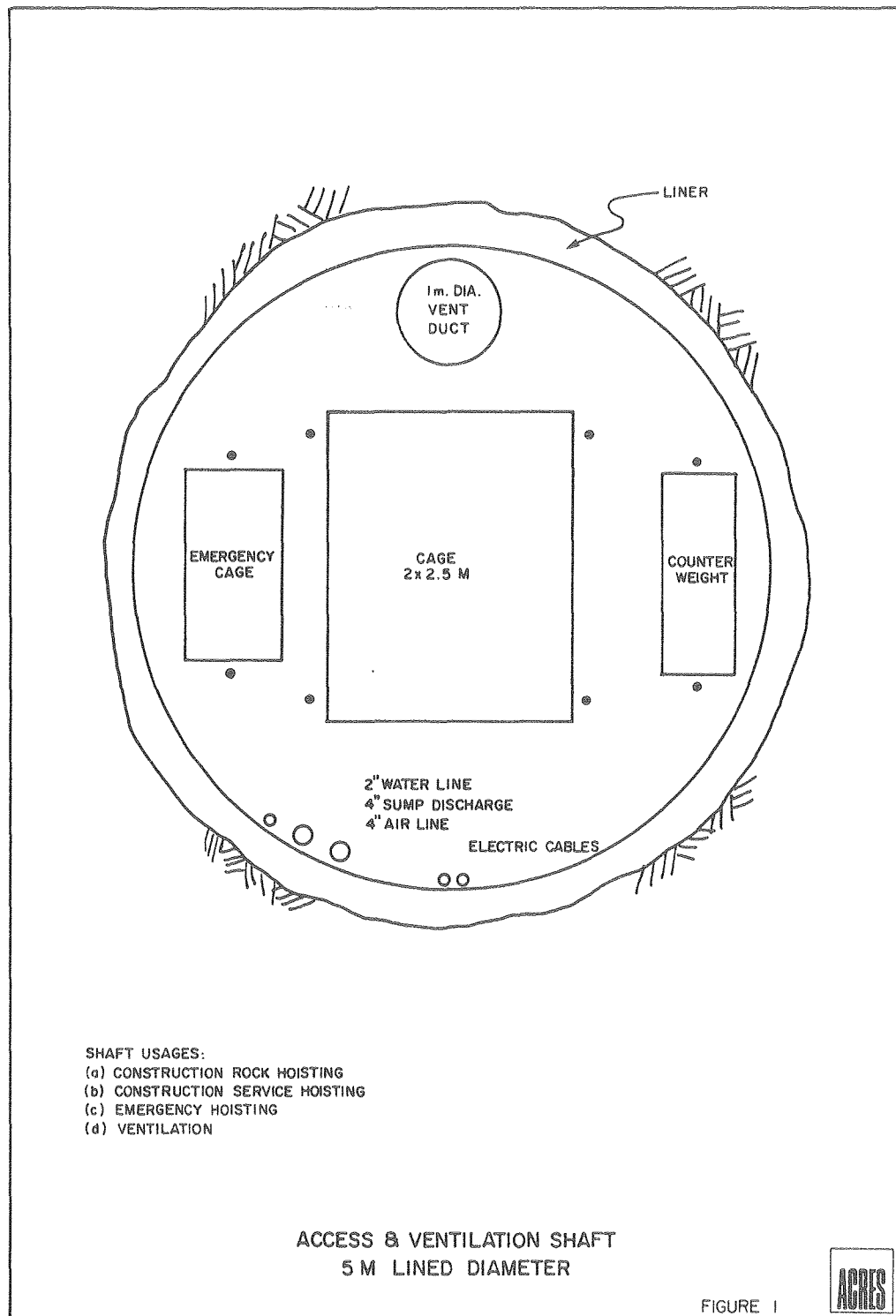
TABLE 8
COST SUMMARY

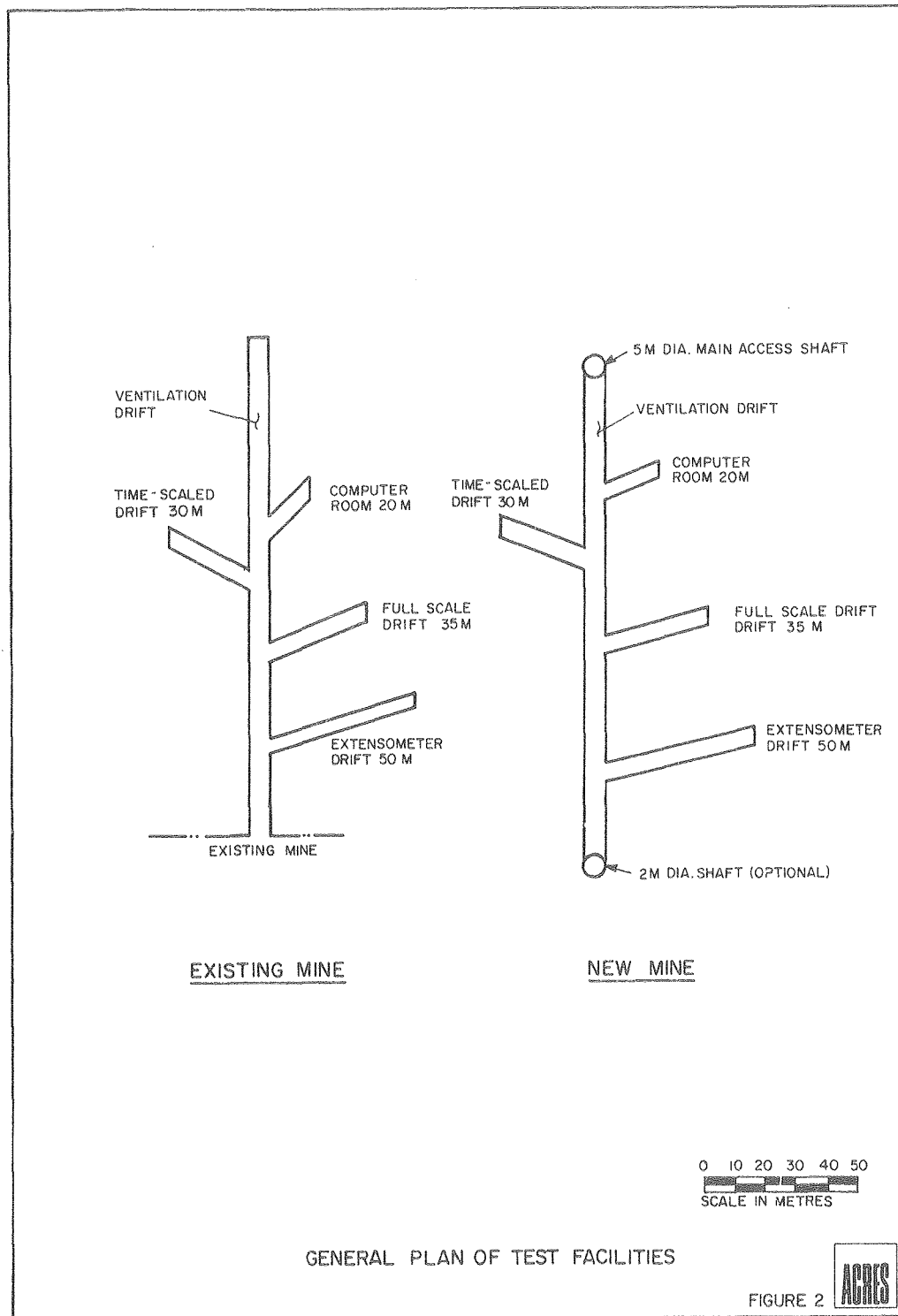
<u>Description</u>	<u>New Mine</u>			<u>Existing Mine</u>		
	Case 1 300 M	Case 2 700 M	Case 3 1500 M	Case 4 300 M	Case 5 700 M	Case 6 1500 M
.1 Surface Drilling	\$ 352,715	\$ 670,800	\$ 1,648,115	\$ 173,960	\$ 310,320	\$ 734,860
.2 Shaft Sinking	3,749,025	5,671,550	9,491,675	---	---	---
.3 Facility Development	634,063	747,125	1,008,975	513,125	513,125	513,125
.4 In-Mine Drilling	549,680	549,680	549,680	549,680	549,680	549,680
Subtotal	\$5,285,483	\$7,639,155	\$12,698,445	\$1,236,765	\$1,373,125	\$1,797,665
20% Contingency	1,057,097	1,527,831	2,539,689	247,353	274,625	359,533
Total	<u>\$6,342,580</u>	<u>\$9,166,986</u>	<u>\$15,238,134</u>	<u>\$1,484,118</u>	<u>\$1,647,750</u>	<u>\$2,157,198</u>

Optional

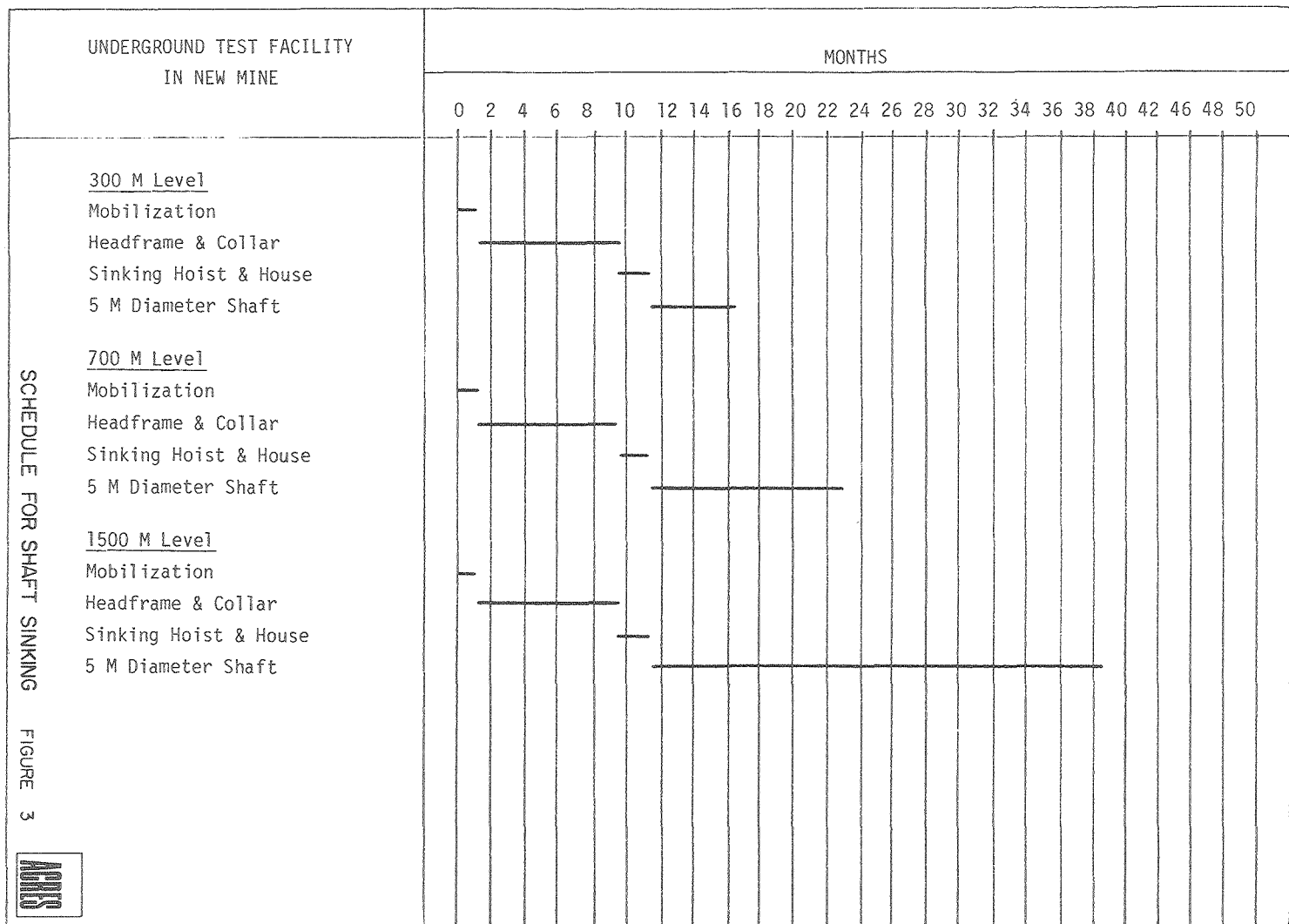
Atimak	\$ 435,875	\$ 992,125	\$ 2,104,625
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FIGURES





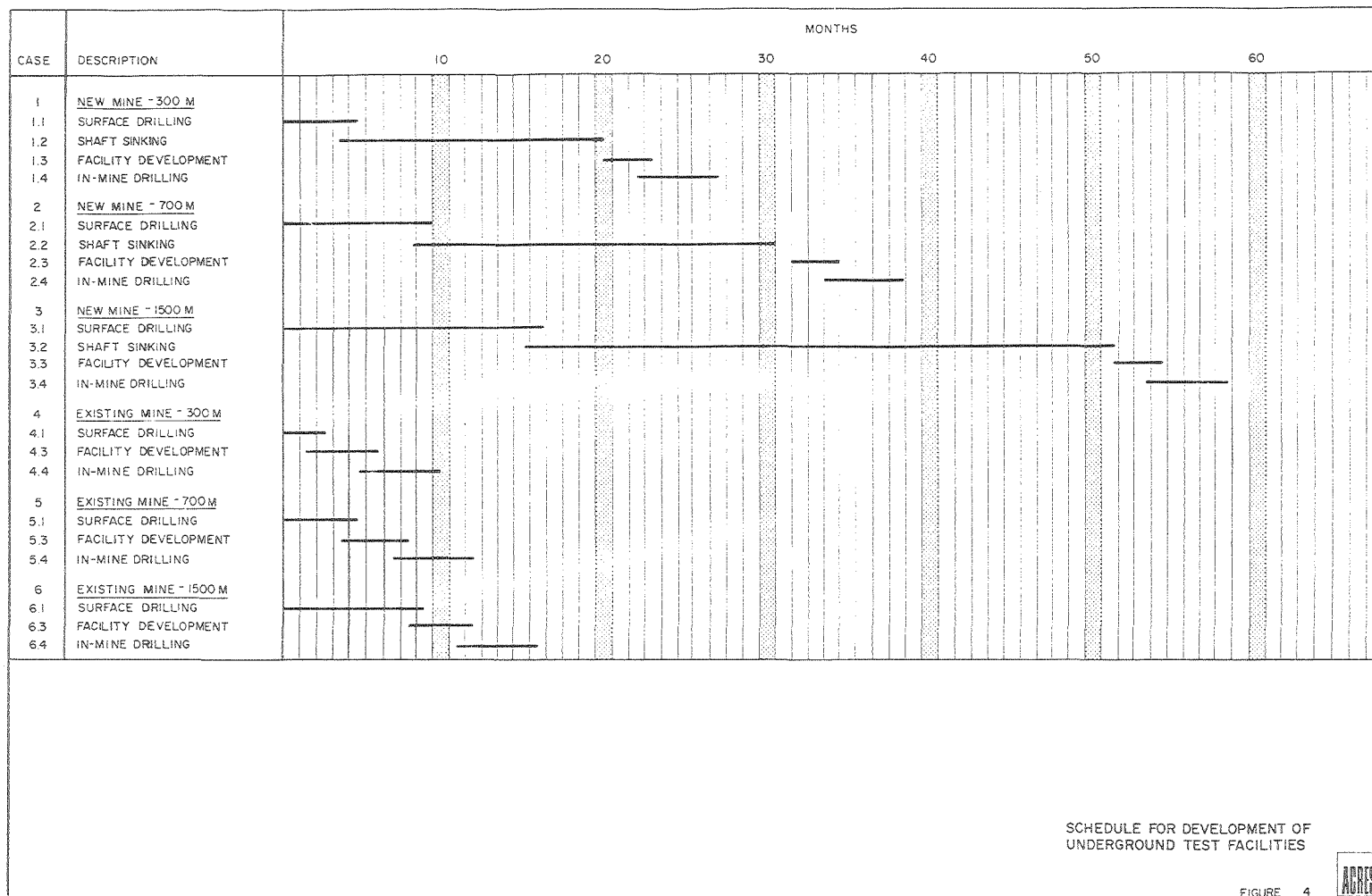
XBL 8010-12474



SCHEDULE FOR SHAFT SINKING

FIGURE 3





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